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ABSTRACT

The purpose of the project described in this report was to investigate the feasibility of interactive microcomputer/videotape software for use in Texas vocational agriculture programs. An extensive literature review was conducted to determine the value of videotaped and interactive videotaped lessons and to check what equipment and programs were available. The necessary interfaces between existing microcomputers and videotape hardware commonly found in Texas were determined. Project investigators then developed the interactive video software for a course on auto mechanics and pilot tested 2 lessons on small engine operation and maintenance with 55 students from 4 Texas high schools. (Handicapped students were included.) Students were divided into two groups: one control group which was taught with video and the other which received instruction by interactive video. Students were tested for immediate recall and by a posttest about one week later. Each test consisted of two questions. As measured by the immediate recall test, interactive video was rated a significantly superior method of presenting selected small gasoline engine topics; however, the posttest showed no significant difference between the outcomes of the two methods. Further recommendations were made for further research using more students, more questions, and more subject areas before implementing interactive video technology. (The report presents a detailed, step-by-step description of the production of the interactive videotape lessons. A seven-page bibliography is provided; the appendixes include the student tests.) (KC)

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Interactive Microcomputer Videotape Software for Vocational Agriculture Programs in Secondary Schools

JUNE 30, 1986

TEXAS TECH UNIVERSITY
LUBBOCK, TEXAS

Final Report

for research performed in cooperation with the Research Coordination Unit, Department of Occupational Education and Technology, Texas Education Agency, Texas.

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CHAPTER 1

INTRODUCTION

Electronic technology, specifically video and microcomputers, is responsible for the new technological or informational society. This change in society has placed an added dimension to "what" and "how" we teach students in our public schools. Although computers are indispensable to science, business, and government, they have not been fully utilized in our educational system. We now have the capability to fully utilize the emotional power of videotape and the interactive power of the microcomputer.

Statement of the Problem

Video, utilizing special effects, is an exciting method of presenting material. Ignatz & Ignatz (1982) found that with a camera and an editing machine, video tapes can be up-dated and localized to make the subject matter more relevant for the student. The microcomputer likewise is a modern tool in the classroom that has been demonstrated to be useful through drill and practice exercises, logo programming, tutorial, simulation, basic programming, word processing, data base management, and spreadsheet operation (Etlinger & Ogletree, 1981; Rodenstein & Lambert, 1982; Wright, 1981). In studies conducted by Etlinger and Ogletree (1981), results indicated that computers reinforce basic skills, reinforce problem solving abilities, promote-logical thinking, encourage creativity, and provide stimulation and motivation. According to Henderson (1983) computers

have also been shown to improve student performance in terms of achievement and attitude in a variety of subjects.

Wright (1981) observed that video alone is generally recognized as a passive exercise whereas operating a microcomputer is an active one. She further noted that interactive video links the two mediums together and thus requires active participation from the student. Smith and von Feldt (1977) stated that, "It would appear that combining the sound and motion of television with the interactive drill and practice of CAI [computer assisted instruction] would provide for greater gains in a shorter period of time" (p. 12).

This project was needed in order to determine if the two electronic mediums (videotapes and microcomputers) should be utilized in vocational agriculture. Therefore, the following purpose and objectives were developed.

Purpose and Objectives

The purpose of this proposed project was to investigate the feasibility of interactive microcomputer/videotape software for use in Texas vocational agriculture programs. To accomplish this purpose, the following objectives were developed:

1. Determine the necessary interfaces needed between existing microcomputers and videotape hardware commonly found in Texas.
2. Develop the interactive video software for the three subject matter areas (essential elements) of animal science, plant science, and agricultural mechanics for the

most common videotape and microcomputer hardware found in Texas.

3. Pilot test and evaluate the developed software with selected vocational agriculture students.

Definition of Terms

Videotape: "Electromagnetic tape on which the electronic impulses produced by the video and audio portions of a television program, motion picture, etc., are recorded by special equipment" (Henley, 1983, pp. 5-6).

Videodisc:

> ...[it] looks like a 12-inch record with mirror-like rainbow surfaces. The laser-etched surface of the thin metal disc is protected by a clear plastic coating. The laser beam, guided by the video signal input, scores the surface during recording to create pits. During playback, a laser beam on the videodisc player reads the array of pits, reconstituting them into a video image on the monitor. (D. J. Clark, 1984, p. 13)

Interactive Video (IAV): The combining of a microcomputer to a videotape player or a videodisc player for the purpose of joining audio and video presentations to the interactive capabilities of computer-assisted instruction (CAI) to present lessons.

Vocational Education for the Handicapped (VEH): a vocational education program offered for students identified as being "handicapped."

Handicap: "...something that hampers a person; disadvantage; hindrance" (Webster's New World Dictionary, 1974, p. 634).

> "The term 'handicapped,' when applied to individuals, means individuals who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, or other health impaired persons, or persons with specific learning disabilities, who by reason thereof require special education and related services, and who, because of their handicapping condition, cannot succeed in the regular vocational education program without special education assistance" [Section 521(15), Public Law 98-524]. Handicapped students at the secondary level will be those students who have been identified by special education personnel as being eligible for special education services. Handicapped students in post-secondary and adult vocational education will be self-identified as having one of the identified handicapping conditions listed in the above federal definition. (Texas Education Agency, 1985, p. 22)

Coordinated Vocational Academic Education (CVAE): a vocational education program offered for students identified as being "disadvantaged."

Disadvantaged:

> "The term 'disadvantaged' means individuals (other than handicapped individuals) who have economic or academic disadvantages and who require special services and

assistance in order to enable them to succeed in vocational education programs. Such term includes individuals who are members of economically disadvantaged families, migrants, individuals who have limited English proficiency and individuals who are dropouts from, or who are identified as potential dropouts from, secondary school" [Section 521(12), Public Law 98-524]. (Texas Education Agency, 1985, p. 22)

Economically Disadvantaged:

...individuals who are determined to be low income. This may include individuals whose (1) family income is at or below national poverty level; or whose (2) parent or guardian is unemployed; or whose (3) parent or self is a recipient of public assistance. An economically disadvantaged person in vocational education may also be determined at the elementary or secondary level as one who participates in a free or reduced lunch program and at the post-secondary and adult levels as one identified from state and federal student financial aid records. (Texas Education Agency, 1985, p. 22)

Academically Disadvantaged:

...individuals [who] are one or more years below grade level in achievement in three or more academic classes, or have a composite score on a standardized test indicating below grade level performance. An academically disadvantaged student in vocational education will be determined at the secondary level as those students

enrolled in remedial programs in mathematics, English, language arts, or reading. For post-secondary and adult levels, academically disadvantaged students are those enrolled in remedial instruction or on academic probation. (Texas Education Agency, 1985, p. 22)

Migrants:

...students whose parent or guardian is a migratory agricultural worker or a migratory fisher who has moved within the past 12 months from one school district to another - to enable the child, the child's guardian, or a member of the child's immediate family to obtain temporary or seasonal employment in an agricultural or fishing activity. This definition also includes a student who has been eligible to be served under the preceding sentence, and who, without the parent or guardian, has continued to migrate annually to secure temporary or seasonal employment in an agricultural or fishing activity. (Texas Education Agency, 1985, p. 23)

Limited English Proficiency (LEP):

...any member of a national origin minority who does not speak and understand the English language in an instructional setting well enough to benefit from vocational studies to the same extent as a student whose primary language is English. These persons may include: (1) individuals who were not born in the U.S. or whose native tongue is a language other than English; and (2) individuals who come from environments where a language

other than English is dominant and thus have difficulties speaking and understanding instruction in the English language. A person with 'limited English proficiency' can be identified as a student participating in an English as a second language (ESL) or bilingual program, scoring low on an English proficiency test, or being reported on the Bilingual Census. (Texas Education Agency, 1985, p. 23)

CHAPTER II

REVIEW OF LITERATURE

An extensive review of the literature was conducted on microcomputers and their usage in education, video instruction in education, and interactive video in education and in industry and government training. Computer usage with handicapped and disadvantaged learners was also reviewed. Much research has been conducted using microcomputers in education with a limited amount being done with the handicapped population. On the other hand, very few studies have been conducted using videotape as the teaching medium. Interactive video is the newest delivery system of the three discussed here. Though still relatively new, much has been written about it, but little true empirical research has been carried out.

Microcomputers: Uses, Benefits, and Drawbacks

Microcomputers can be used in a number of different teaching roles to teach numerous subjects. Four main uses of the microcomputer are drill and practice, tutorial, simulation, and problem solving. Tesolowski, Wallin, Roth, and Rankin (1984) define each of these. Drill and practice helps students to master a subject after the material has been presented by the instructor. Repetition of the subject with some type of immediate feedback is featured. The tutorial method presents new material which is normally presented by a teacher, a book, or an audio-visual medium. Questions are usually interspersed throughout the tutorial to assess the amount of absorption and understanding on the part of the student. Problem

Solving enables a student to obtain a more in-depth understanding ofproblem strategies by teaching logically ordered thought processes in approaching a particular problem. Simulation involves presenting life-like situations that would normally be too difficult or dangerous to experience. Kearsley and Frost (1985) point out that simulation teaches decision-making, problem-solving, and judgmental skills.

Giesemann (1985) suggests some examples for each of these uses, specifically, as they apply to instruction in vocational agriculture. Using drill and practice, a student might work on parliamentary procedure, prepare for quiz contests, or learn the breeds of cattle. Calculating board feet, determining feed rations using the Pearson Square method, and reading a ruler are all tutorial programs that could be presented. Problem solving might consist of determining harvest losses or developing commodity budgets. Simulations could include calculating loans inserting different interest rates and time periods for payback or developing a spreadsheet on a beef operation including price, calf crop percentage, rate of gain, and other factors to determine the net profit.

Computer assisted drafting (CAD), career counselling guidance, communication aids, computer assisted music composition, office vocational education, and word processing are other uses of the microcomputer recommended by Hanley (1983). Additional uses include gaming and discovery (Hannaford, 1983), teaching hand-writing skills using a graphic display screen and a hand-held "pen" (Macleod & Procter, 1979), data base and spreadsheet operation and computer programming (Rodenstein & Lambert, 1982), and computer-managed

instruction, assessment and evaluation, and data retrieval (Taber, 1981). Obviously, microcomputers can be used in a number of different ways. Paulson (1986) noted their value in group and/or classroom instruction or in independent study. He adds that computers, themselves, can be taught in vocational agriculture.

Computer programming is a field of study within itself. One language of particular interest in the field of education is the LOGO language. Russell (1983) points out that a student can translate what he knows about proportion and shape into LOGO commands which require skills in estimating, comparing, sequencing, visualizing, planning, and using numbers.

Several sources were in general agreement as to the benefits of microcomputers. Braden (1985b), Carman and Kosberg (1982), Dalton and Hannafin (1984), Deitel (1984), Ignatz and Ignatz (1982), Rieth and Semmel (1979), Rodenstein and Lambert (1982), Taber (1981), Tesolowski et al. (1984), and Wright (1981) each suggest one or more of the following benefits of computer usage:

1. It offers individualized, private instruction.

2. It provides immediate feedback, reinforcement, and evaluation.

3. The student controls the pace of the lesson.

4. It is a persistent teacher that displays infinite patience resulting in less stress in the classroom.

5. Student progress is recorded automatically.

6. Instruction is available on short notice with minimal inconvenience to the teacher.

7. The computer requires active participation as opposed to passive observation.

8. It provides non-judgmental interaction.

9. It teaches processes through sequential steps.

10. It can teach the same amount of material in less time with as good as or better retention than if taught by conventional means.

Budnick (1983) notes that the tutorial is a potentially powerful method of instruction. He points out that the student can control the pace that the material is presented. The computer can evaluate the student's progress by interjecting questions and can "branch" to a more appropriate level of presentation (either simpler or more complex) to meet the student's immediate needs. He further comments that this is something that books cannot do.

Tesolowski et al. (1984) further noted that drill and practice exercises in computer-assisted instruction (CAI) have had positive impacts on learning when compared to conventional teaching methods. They state that computers maximize the application of reinforcement by providing immediate feedback on an individualized basis which will help motivate and reinforce student progress. They further state:

> If the education profession can rise to meet the potential of the microcomputer, individualized instruction might become a reality. Eventually, microcomputers may facilitate the implementation of competency-based vocational education by allowing students to proceed at their own pace without the fear of failure. (p. 18)

Additionally they recommend that a computer be used as a tool to help personalize education by taking care of some of the record keeping and other repetitive tasks of the teacher to provide more time with the students.

As with any instructional method, there are drawbacks to computer usage. Bender and Church (1984), Cepica and Igo (1985), Deitel (1984), Friedman and Hofmeister (1984), Hannaford (1983), Hannaford and Taber (1982), Paulson (1986), Rieth and Semmel (1979), Russell (1983), and Schiffman, Tobin, and Cassidy-Bronson (1982) name one or more of the following weaknesses in computer usage in education:

1. There is limited hardware available to teachers due to the high initial cost.

2. Most educational software is lacking in educational compatibility, instructional design, and technical adequacy.

3. There is very little training offered to teachers.

4. The teacher may have little to no time or may be unwilling to partake in training.

5. The teacher has a lack of knowledge concerning computer applications in the classroom and laboratory.

6. The computer is still viewed by some teachers and administrators as being nothing more than a "passing fad."

7. There is a lack of scientific research evidence concerning the effectiveness of computer-assisted instruction.

8. The computer has an appearance of being impersonal.

Bender and Church (1984) point out that most resistance to computers in education comes not from the students but from the teachers and the administrators. Hannaford (1983) suggests that educators are relatively uninformed about computers and their possible uses in education. He further notes that as a result of this, there is still resistance to this "new technology". Schiffman et al. (1982) state that many teachers and administrators are unwilling to accept the computer as a viable teaching tool and to spend the time in training to learn how to use it.

Perhaps the the most apparent weakness is in the software. Hannaford and Taber (1982) list three main problems with software:

1. A particular piece of software cannot be used on all computers. In fact, more times than not, software will only work on one particular brand.

2. Unfortunately, more emphasis may be placed on the technical aspects of instructional software than on the educational value. It is not uncommon to find software programs with inaccuracies, misspellings, and incorrect grammar.

3. Many programs are narrow in scope. It may teach a minute skill or segment of a skill rather than the entire unit or process it is advertised as being able to teach.

Schiffman et al. (1982) elaborate by pointing out that there is indeed a scarcity of good educational software. They state that most educational software is uninspired and merely a duplication of a textbook. Russell (1983) states that computer software should provide motivation through intellectually compelling content. She notes that

some software is highly motivating but lacks any learning potential. Russell contends that, on the other hand, some software is loaded with good learning content but lacks any inspiration.

Video: Uses, Benefits, and Drawbacks

Henley (1983) lists several uses of videotapes. These include problem-solving, Future Farmer of America (FFA) leadership development, recording important events or speakers for future viewing, interviewing prospective employers for career exploration, and showing demonstrations, field trips, and supervised occupational experience programs to classes.

Henley further notes several advantages that videotape instruction possesses. Up-to date information on the changing field of agriculture can be captured on film and conveyed to students within a matter of hours in an attractive and appealing manner. Priestman (1984) states that videotape is less expensive to record onto from camera than other methods of filming. Priestman (1984) and Ignatz and Ignatz (1982) maintain that videotapes are relatively easy to edit and re-edit quickly with updated material or subject matter which is on a more appropriate level for the audience. Of course, these two benefits are attainable if the user has the appropriate filming and editing equipment.

Henley (1983) referred to a study comparing two types of presentation: videotapes and the lecture method. Six objectives of learning were identified for this particular experiment: (a) learning factual information; (b) learning visual identifications; (c) learning principles and concepts; (d) learning procedures; (e) performing

skilled perceptual-motor acts; and (f) developing desirable attitudes and motivations. In terms of effectiveness, videotapes scored equal to or higher than the lecture method in all six objectives. Henley states, "When used correctly by teachers, videotapes enable the students to visually appraise technical subject material and to establish a more practical understanding of the material" (p. 1).

Among the drawbacks to videotape usage, D. R. Clark (1984) notes that the learner has very little to no control over the pace of the instruction conveyed by videotape. Dalton (1986) and Wright (1981) state that video is generally regarded as a passive instructional delivery system whereby learners do not actively participate in the learning process. Henley (1983) suggests that when videotapes are used as a supplement, results will be more positive than when they are used to "replace" the teacher.

Henley cited a study that examined the effectiveness of teaching two units of agricultural subject matter by comparing two methods of instruction: actual presentation and a videotape replay. On the basis of cognitive or affective learning, the videotape group learned as effectively as the actual presentation group. However, in comprehension learning, the videotape group scored significantly lower than the other group.

Interactive Video: Uses, Benefits, and Drawbacks

Roach (1984) states that interactive video is the combining of video with computer technology which results in joining the still and moving pictures with sound of video with the responsiveness and interactivity of computer-assisted instruction (CAI). Even though the

earliest recorded usage of interactive video is 1979, many applications and uses have already evolved. D. J. Clark (1984), Doulton (1984), Ebner, Manning, Brooks, Mahoney, Lippert, and Balson (1984), Friedman and Hofmeister (1984), Kearsley and Frost (1985), Priestman (1984), Staff (1984), and Staff (1985) each refer to one or more of the following subject areas which have been taught utilizing IAV: (a) CPR, (b) science experiments, (c) aircraft maintenance, (d) geography, (e) administering injections, (f) telling time, (g) operating tank gunnery system, (h) physics, (i) electronics, (j) gastroentrologist diagnosis skills, (k) computers, (1) word-processing, (m) biology, (n) test-taking skills, (o) economics, and (p) chemistry.

The variety of subjects which can be taught by IAV appears to be unlimited. Staff proposes that, "Virtually any educational videotape can be made interactive" (1984, p. 40). They go on to point out that IAV can be utilized in three distinct areas of classroom instruction:

1. It can be used for poor readers who may benefit more from watching a lesson than reading one.

2. Students who miss class could use an IAV lesson to make-up the work on their own time.

3. It is an ideal tool for substitute teachers.

Griffiths (1984) points out that the primary advantage of IAV over videotape instruction is that IAV has the capability to randomly access any video segment more quickly than manually searching videotape on a video player. This is particularly true when videodisc is used rather than videotape. According to Priestman (1984), access

time to any one frame of the 54,000 frames on the entire videodisc is 4 seconds or less while Friedman and Hofmeister (1984) suggest a maximum access time of less than 3 seconds. D. J. Clark (1984) observes that less disruption in learning occurs with the rapid access feature of the videodisc. He states,

> Attention to task results in more efficient learning, better comprehension, and increased retention. Interactive videotape suffers from clumsy searches during branched programing. This is disruptive to learning. While careful design can offset some of this difficulty, it ultimately fails to avoid the delays and disruptive learning patterns. Videodisc's speed of access obviates this problem. (p. 14)

Friedman and Hofmeister (1984), Novak and Ver (1984), and Priestman (1984) point out other advantages of videodisc as compared to videotape. These include freeze frame with better stability, longer still time, step forward and step backward features, and no wear. Videotape has limited freeze-frame capability, relatively slow access time, and some wear.

Kearsley and Frost (1985) noted a study conducted by American Bell on the effectiveness of training in branch offices. Results indicated that videodisc was more effective than classroom, text, slide, or videotape training. Kearsley and Frost also cited a study which was conducted comparing two different types of videodisc formats: one which was an exact duplicate of a film/slide presentation and one in which review frames had been added. Results

indicated that both groups did about the same; thus, it was concluded that videodisc has no inherent advantages given content originally developed for other media.

Several authors noted several benefits which IAV and computers share. Braden (1985b) lists some of these: (a) student controlled pacing, (b) immediate feedback, (c) individualization of lessons, (d) a more patient and persistent "teacher", (e) progress of the student recorded automatically, and (f) instruction available on short notice with minimal inconvenience to the teacher. Ignatz and Ignatz (1982), Kearsley and Frost (1985), Priestman (1984), and Staff (1985) reinforce Braden's assertions by noting that IAV's branching capabilities individualize lessons for the students in terms of the pace of presentation as well as the depth of the subject material. As with the computer, IAV offers tutorial, drill and practice, problem-solving, and simulations instructional methods. Ignatz and Ignatz (1982) reveal that IAV offers students the opportunity to study difficult material several times until they master it. In addition, Priestman (1984) and Wright (1981) observe that IAV requires the active participation of the student much like the computer does.

The opinion is shared by several of the authors that IAV can enhance CAI in a number of ways. Friedman and Hofmeister state,

> One limitation of CAI has been the prerequisite reading skills that many CAI programs require. Alternatively, the videodisc, with its audio capabilities, provides spoken instruction, thus obviating the need for reading skills. It can also provide high-quality, real-life images. When

> combined with a microcomputer to give it directions based on student responses, the videodisc has the potential to be an 'intelligent,' highly interactive, instructional medium. (1984, p. 130)

Dalton (1986) remarks that CAI may be improved with video images through IAV instruction. He explains that research shows that interactive video with a variety of visual and auditory learning stimuli can improve learning significantly. Ebner, Danaher, Mahoney, Lippert, and Balson (1984) further note that IAV present a variety of video information in ways that are more realistic than a computer. Deitel (1984) observes that a common criticism of computer assisted instruction is its appearance of being impersonal. He recommends interacting the computer with video may make it more personal by including recorded questions, answers, and explanations by a teacher.

Ebner, Danaher, et al. (1984) note that IAV presents a variety of video information in ways that are more realistic than a computer. Grabowski and Aggen (1984) remark that videodiscs can expand and enhance the capabilities of the computer by providing the computer with an audio and visual library of resources. Howe (1985) comments that IAV allows the development of a wide range of educational software that so far has been impossible to create on the computer alone. Ignatz and Ignatz (1982) explain that existing videotaped lectures and demonstrations may be incorporated into CAI lessons. Roach states,

> The combination [of the computer and video] is much greater than the sum of its parts, providing the most

> powerful individualized learning medium so far developed - more flexible and more effective than our clumsy initial attempts to exploit it have demonstrated... (1984, p. 187)

Animation is another area which IAV can greatly extend the capabilities of the computer. Ebner, Danaher, et al (1984) suggest that animation can be valuable in presenting complex material, particularly in the area of the sciences. Kearsley and Frost (1985) state, "Animation is an important visual capability of videodiscs. This can be created via traditional film techniques or computer generated graphics." (p. 10)

Smith and von Feldt (1977) state, "It would appear that combining the sound and motion of television with the interactive drill and practice of CAI would provide for greater gains in a shorter period of time" (p. 12). D.J. Clark (1984), Doulton (1984), Ebner, Manning, et al (1984), Kearsley and Frost (1985), and Priestman (1984) note that IAV has indeed been shown to improve student achievement gains, raise retention levels of the subject material, and save time in learning when compared to other teaching methods such as CAI and traditional classroom lecture. Staff (1984) cited a study conducted at Omar Bradley Middle School in San Antonio, Texas where 410 seventh grade science students were divided into three groups: Group 1 - lesson over the biological control of insects presented by video; Group 2 - the same lesson presented by video followed by discussion with a teacher; and Group 3 - the same lesson presented by interactive video. A quiz was given over the material the next day. Group 1 scored the lowest, Group 2 scored the next lowest, and Group 3 (the

interactive group) scored substantially higher. In fact, Staff referring to the IAV group, states, "...almost all of them [scored] at or above the 90th percentile, while those in other categories rarely exceeded the 80th percentile" (p. 29).

Staff (1985) mentioned another study where IAV was compared to conventional learning methods. Students receiving instruction by IAV in performing science experiments performed the experiments as well as and in some cases better than the conventionally trained group. It was further noted that students in the IAV group were significantly more confident in following instructions and were able to work their way through experiments in a more systematic way than the other group. Doulton (1984) also pointed out the advantages of conducting science experiments with IAV. He explains that the time spent setting up the experiment and cleaning up afterwards is saved when using IAV. Thus, more time can be spent on the actual experiment possibly even allowing a far wider range of exploration for the advanced student. Doulton also observed that aircraft maintenance engineers are now able to work with a small interactive video player strapped to their helmets which shows how each part fits together so that the engineer does not have to climb down out of the plane to refer to the instruction manual.

Ebner, Manning, et al (1984) refer to a study teaching students how to administer intramuscular injections. In the study IAV saved considerable training time over the conventional classroom method. The training program was broken down into three separate phases: demonstration, practical exercise, and study hall. The conventional method consumed 100 minutes in the demonstration phase, 100 minutes in

the practical exercise segment, and 135 minutes in study hall for a total time of 335 minutes (5 hours and 35 minutes). In comparison the IAV program took 55 minutes in the demonstration portion, 50 minutes in the practical exercise phase, and 105 minutes in study hall for a total time of 210 minutes (3 hours and 30 minutes). Thus, in this particular training program IAV saved 2 hours and 5 minutes of training time over the conventional method. Kearsley and Frost (1985) cited several studies which also resulted in saving of time and higher achievement gains when IAV was used as opposed to another instructional method.

Ebner, Manning, et al (1984) warn against judging IAV solely by its effectiveness as a teaching medium. They contend that if there is not a significant difference in achievement scores when comparing IAV to other instructional methods, but it is a more cost effective means of delivery, then it should be considered a favorable method of instruction. Staff (1985) suggests that utilizing IAV to simulate science experiments can save money over actually performing the experiments year after year. They further note that access to these experiments via videodisc can be substantially increased for more people through libraries of which many are open 18 to 24 hours a day.

Though IAV has proven to be cost effective in some cases, D. J. Clark (1984) and Braden (1985a) point out that high cost is also a drawback. Braden offers some cautions on IAV:

1. The potential of IAV in education is being oversold. IAV is not and probably never will be an 'all purpose' instructional delivery system.

2. IAV is becoming a buzz word, and being involved with IAV is the Faddish thing to do.

3. IAV is too costly. Unless we are very lucky, IAV will have lost its allure before the public school systems can afford it.

4. The general fascination over the technological elegance of IAV is obscuring the real problems that we educational innovators face in bringing this very promising development into the educational mainstream. (p. 33)

He goes on to add that not too long ago educational experts were saying that instructional television (ITV) was the educational panacea. Many optimists jumped on the ITV bandwagon only to be disappointed later when ITV did not live up to expectations. Braden recommends two management guidelines in order to seek cost-effectiveness:

(1) Restrict the use of IAV to those applications where this new medium has instructional advantages, and (2) Produce educationally efficient courseware or none at all. The litmus test must be that either the teacher's job or student's task (or both) shall be made easier by IAV - otherwise, we cannot justify the price. (p. 34)

Dalton (1986) conducted a study comparing instruction via linear video alone, CAI alone, and IAV. He stated,

It might be assumed that the interactive video treatment, by virtue of its video enhancements and individualization, would be the most effective in producing high levels of

> performance. However, this assumption was not supported by this study for two principal reasons. First, the interactive video equipment was very new to these students. Observations made during the lessons indicated that the learners were somewhat distracted by the various noises and indicator lights produced by the videotape players in this treatment. Second, the delays caused by long tape access times may have given the learners the opportunity to drift and not actively participate in the instruction. On the other hand, these learners were familiar with CAI lessons, so this medium provided no such distractions and its more direct nature seemed to keep these learners more "on task." (p. 29)

As already mentioned, D.J. Clark (1984) notes that using videodisc with its rapid access feature would help to alleviate the problem caused by using videotapes.

Braden (1985b) suggests three tests for selecting IAV as an instructional tool:

1. The image test: "Will the instruction be more powerful, more efficient, or otherwise better if motion is shown or a large collection of images is accessible?" (p. 33).

2. The CAI test: "Will some or all of the six key advantages of IAV/CAI be critical goals for the project?" (p. 33).

3. The impact test: "Will the potential project fully exploit the power of your equipment, the talent of your design and production staff, and the higher order learning skills of the students?" (p. 33).

He specifies that one must be able to answer yes to all of the above questions to justify IAV. Braden (1985a) states that "...to achieve educational efficiency means IAV must be designed by people who are knowledgeable about computers, instructional television, learning theory, instructional design, interactive strategies, and the subject being taught" (p. 34).

Applications for Special Needs Students

Wright (1981) identifies three groups of special needs students: (a) learning disabled, (b) socially disadvantaged, and (c) very gifted. Indeed, this is only a partial list. Special needs students within the educational context are handicapped and/or disadvantaged to the extent that they are unable to succeed in the regular classroom. Cole, Egbert, and Suzuki (1984) cite the Federal Register as saying,

> "...those students who are identified as requiring special education must be unable to succeed in the regular vocational education program without special educational assistance or must require a modified program. 'Handicapped' means a person who is mentally retarded; hard of hearing; deaf; speech impaired; or other health impaired person, or persons with specific learning disabilities... The classification system for the disadvantaged is designed to include all persons who have academic or economic handicaps and who require special services and assistance to enable them to succeed in vocational education programs." (Federal Register, Vol. 42, No. 195, Section 16). (p. 18)

Cole et al. go on to point out that these criteria include the following reasons for which a student is not succeeding or cannot be expected to succeed:

1. A handicap interferes with the success or attainment of the required objectives.

2. An academic disadvantage does not permit the acquisition of the necessary skills for success in the program.

3. An economic disadvantage which has caused the student not to learn appropriate work habits and attitudes for a particular type of job related to training in the vocational program.

4. Limited-English-speaking proficiency.

According to Cole et al., if taken to an extreme, almost everyone has some type of special need, from something less than 20/20 vision to insufficient upper body strength to the inability to read at a desired level or speed. They go on to suggest that some of these shortcomings can be compensated; i.e. eyeglasses, hearing aids, etc. while other handicaps can be compensated without special help. Collins and Mohr (1985) point out that a student is considered to be handicapped when he does not have the ability to perform at the levels expected of him.

The disadvantaged student has several unique characteristics suggested by Downey (1985). They include (a) students from broken homes, (b) students who have been retained a grade level or more, (c) students disinterested in school, (d) students who are underachievers in school and lack personal goals and self-confidence, (e) students

who come from low-income families, (f) students who have a negative attitude toward school, and (g) short attention span.

Emotionally disturbed students have some of these same problems according to Carman and Kosberg (1982). They note that a common characteristic of all emotionally handicapped children is their lack of ability to concentrate on their school work for extended periods of time. They comment that this may be due to task avoidance because of past school failures, hyperactivity, the need for uninterrupted adult attention, or other internal distractions. Because of this lack of concentration, the student many times falls behind.

Downey (1985) remarks that teachers of disadvantaged and handicapped students must be creative. She explains that students become bored when the same teaching method is used over and over. She further contends that short class periods and a variety of teaching techniques help hold student interest. Collins and Mohr (1985) observe that handicaps, especially mental, are particularly noticeable in the area of academics. Many times the social punishment resulting from this disability can be more of a handicap than the actual handicapping condition. They suggest that if handicapped students are treated as second-class citizens, it is no wonder that they have difficulty learning.

Scanlon and Baggett (1985) refer to the second paragraph under the statement of purpose of the Carl D. Perkins Vocational Education Act of 1984 which states:

> ...assure that individuals who are inadequately served under vocational education programs are assured access to

quality vocational education program, especially individuals who are disadvantaged, who are handicapped, men and women who are entering nontraditional occupations, adults who are in need of training and retraining... (p. 5).

United States Department of Education (1984) note that Section 601(c) of Public Law 94-142, The Education of All Handicapped Act, states the purposes of the Education of the Handicapped Act:

1. assure that all handicapped children are provided a free appropriate public education.

2. assure that the rights of handicapped children and their parents are protected.

3. assist the States and localities to provide for the education.

4. assess and assure the effectiveness of efforts to educate this special population.

Schiffman et al. (1982) further comment that Public Law 94-142 specifies that special education must be extended to all children with learning problems of any type through the delivery of multidisciplinary and interdisciplinary services designed to treat individual special needs.

Stainback and Stainback (1984) note that special education was begun over a century ago to meet the academic requirements of exceptional and special needs students. United States Department of Education (1984) observes that the number of handicapped children who receive special education continues to rise as it has each year since

the initial child count in 1976-77. They remark that the 1982-83 count was 4,298,327 served which is an increase of 65,045 (or 1.5 percent) over the previous school year and a 16 percent increase over the 1976-77 school year. They go on to point out that the number of handicapped students served in relation to the total number of students enrolled in pre-school through twelfth grade rose from 10.47 percent in 1981-82 to 10.76 percent in 1982-83. According to their report, less than 7 percent of all handicapped students receive their education in separate schools. Of the remaining 93 plus percent who are taught in regular schools, two-thirds are educated in the regular classroom with nonhandicapped students.

Killen and Myklebust (1980) explain that educational growth has become the chief criteria in measuring the success of a special education program as opposed to numbers of children enrolled. They state, "...the degree to which each child benefits from individualized programs is the basis for evaluation" (p. 35). Wright (1981) states, "In order to progress through school, a child 'needs' critical levels of intelligence, sight, hearing, motor co-ordination and communications skills" (p. 9). She further comments that a special education student depends heavily on a teacher. Educating special needs students requires a high degree of individualized instruction because no two students have the same needs. She notes that at some point, the student must develop independence in education. She suggests that new technology can help "wean" the student from depending so much on the teacher. According to Friedman and Hofmeister (1984), a lack of independent work skills on the part of

handicapped students constitutes a major obstacle to individualizing instruction. They point out that this is particularly frustrating if the teacher needs to spend instruction time with a small group of students while assigning another individual or group some work to do on their own. They remark that teachers continue to search for creative ways for these students to spend their time while other students are receiving teacher instruction.

Bender and Church (1984) list some critical considerations for the learning disabled. These include:

> ....(1) the need for a failure-free system, (2) the need for developing social-interpersonal skills, (3) immediate positive reinforcement, (4) the need for practical survival skills, (5) increasing the child's sense of competence, and (6) providing a multisensory instructional format. (p. 99)

Geoffrion and Bergeron state, "Perhaps the most universal characteristic shared by handicapped individuals is the inability to communicate effectively through conventional symbol systems" (p. 2). They suggest that animation is an excellent alternative for addressing this problem.

Hanley (1983) identifies four groups of handicapped students most frequently given microcomputer instruction. They are: (a) learning disabled, (b) educable mentally retarded, (c) emotionally disturbed, and (d) students with communication impairments. The Association for Educational Communications and Technology (1983) suggests that possible success in computers with learning disabled

students may be achieved through the use of a word processor, a computerized dictionary, a graphics tablet, a touch-sensitive screen, or a voice synthesizer. Hannaford (1983) observes that the computer can help the deaf to see speech. Rodenstein and Lambert (1982) comment that individualized educational plans (IEP's) can better be fulfilled due to the individualization potential of CAI.

Bender and Church (1984) contend that the BASIC language is inappropriate for learning disabled students for the following reasons: (a) provides little in the way of providing successful experiences in the world of programming, (b) the higher-order skills necessary to use this language are often self-defeating, and (c) provides little or no immediate positive reinforcement for the student's programming efforts.

They suggest that an alternative programming language that has shown some promise with learning disabled students is the Super Pilot language. It is actually an authoring language designed as a simple programming language for creating lessons and programs. Hannaford (1983) remarks that of all the uses of microcomputers in educating the handicapped, perhaps the most beneficial is that of using it to deliver instruction. He goes on to point out 3 distinct advantages in using computers with handicapped: (a) individualization, (b) motivation, and (c) interactive medium. He further declares that perhaps the greatest benefit that the computer offers to the handicapped is its ability to individualize instruction.

Hannaford and Taber (1982) observe that features such as color, motion, and sound are important tools to gain and hold the attention

of the student. They note that the computer can present a stimulus, receive a response, evaluate that response, furnish feedback and reinforcement, and branch to the next appropriate instructional segment. Killen and Myklebust (1980) explain that since special needs students have short attention spans, computers can greatly increase attention spans through color graphics, instant feedback, and personalized lessons that incorporate the student's name. They further note that computers offer unlimited repetition.

Hannaford and Taber (1982) comment that interaction with computers can be nonthreatening which makes CAI particularly attractive for use with the handicapped learner who may have experienced failure in the classroom. They also suggest that motivation is an important ingredient in learning, and computers have proven to be high in motivating students. Rodenstein and Lambert (1982) proclaim, "If anyone is going to benefit from computer technology, the handicapped will" (p. 181). Hanley (1983) states, "There is strong support for prudent use of microcomputers in special education programs. Many instructional features, characteristic of good CAI software, may be particularly beneficial in the education of handicapped children" (p. 1).

However, Hannaford and Taber (1982) caution that for the ultimate benefits of using computers with the handicapped to be realized, appropriate usage must be discovered and applied. They recommend that if the computer will not do as good a job in instructing a student as another available method, do not use the computer. They go on to observe that if the gains realized by using

the computer do not justify the cost of software development or purchase, do not pursue CAI for that particular application.

Schiffman et al. (1982) mentions the lack of computer equipment in the classrooms and their perception by teachers and administrators as weaknesses to CAI. They state,

> ...the potential for computer-based education for handicapped students will not be reached until computers are as handy and usable as blackboards, telephones, and typewriters. Computers must be perceived by teachers and administrators as routine tools, rather than as sophisticated high technology. (pp. 422-423)

Hannaford and Taber (1982) note that software must be compatible with the curriculum. They suggest that reading level in a program is a particularly important consideration when working with the special education student, and lesson instructions should be clear, simple, and thorough without being wordy. There is very little software that has been designed and written specifically for handicapped learners addressing the various special needs. Perhaps a possible solution to this problem would be the creation of a program with a simple authoring language to enable teachers to create and write their own lessons which could be "tailor-made" for each student.

Taber (1981) observes that research indicates that CAI may be more effective with low ability students than with higher ability students. Hanley (1983) states, "...the strongest positive effects of CAI were measured in lower-level coursework and in instruction for 'disadvantaged' or lower functioning students" (p. 1). Tindall (1984)

cited a study which elaborates on some of the other benefits of CAI. He states,

> Four research conclusions about the uses of the microcomputer in the classroom were reached by Gleason (1981). 1) The microcomputer assists learners in reaching instructional objectives; 2) a 20 to 40% savings in time learning is realized as compared to 'conventional instruction'; 3) retention after interacting with programs is as good or superior to conventional programs; and 4) students react very positively to good MCAI [microcomputer assisted instruction] programs and they reject poor programs. (p. 7)

Hanley (1983) cites a case study sponsored by the Special Education Programs, United States Department of Education. He notes that this study shows little difference in the application of CAI between regular education users and special education users. Stainback and Stainback (1984) suggest that all students, not just special needs students, are unique and have individual differences that influence their instructional needs. They state,

> ...there is nothing to warrant that individualized programming should be a privilege provided only to 'exceptional' students. Tailor-made instructional programs should be provided for all students, whether considered bright, handicapped, minority, or average. (p. 103)

Wright (1981) also points out the need to consider various teaching methods for all students. She states,

> It has generally been the case in education that an instructional resource or teaching method developed to help overcome a particular learning disability has found, except in very specialized cases, a useful adaptation in the regular classroom. Examples include various approaches to word recognition (visual, phonetic, contextual), high interest-low-level learning materials and combinations of visual/auditory presentation to meet individual learning styles. (p. 3)

As mentioned at the beginning of the chapter, much has been written concerning CAI, IAV, and to a lesser extent, video. Adaptations of these three instructional methods to special needs students have also been addressed. It is evident that, though there is great potential for using IAV with special needs students, more empirical research with this population in the agricultural education field is necessary to determine its effectiveness as a teaching tool.

CHAPTER III

PRODUCTION OF INTERACTIVE VIDEO LESSONS UTILIZING AN APPLE IIe/PANASONIC SYSTEM

Initial Analyses

According to Iuppa (1984), the first step in producing any type of interactive video program is to determine your objectives. In order to accomplish this, initial analyses are required prior to the development of the program.

The completion of initial analyses is essential prior to producing interactive segments due to three factors: (1) to determine if it is feasible to utilize IAV as an instructional tool, (2) to determine if IAV will accomplish the stated objectives of the lesson, and (3) to determine what type of teaching strategy will be employed. There are three types of initial analyses: front end analysis, task analysis, and learning problem analysis.

A front end analysis simply determines if IAV is the best solution in aiding the students to learn and retain more of the instructional material which is to be presented. Considerations such as cost, availability, and system capabilities should be considered carefully during this analysis. The most important question to answer in this analysis is "Is IAV effective enough to be worth the cost?".

Once it is determined that IAV will be more advantageous for the purpose of presenting instructional material, a task

analysis should be performed. This type of analysis involves researching the subject material which is to be taught. The importance of this type of analysis is to insure that each step or aspect of the instructional material is included in the lesson and that nothing is overlooked. The completion of this analysis will then provide a base from which the specific behavioral objectives of the lesson will be derived. It is important that the objectives are as specific as possible rather than general. This is due to the fact that specific objectives are more measurable through the use of pretests and post tests.

In order to determine the teaching strategy which will be employed in the lesson, the learning problem analysis should be performed next. There are a variety of teaching strategies that can be utilized in producing interactive lessons, ranging from very complex to very basic. Due to the newness of IAV and the lack of an abundance of knowledge for producing complex lessons, the basic instructional strategy utilized in this project was an expositive strategy, one which is used for receptive learning (Romiszowski, 1984). This type of strategy involves presenting information through explanation and then testing for reception, recall and understanding. As the learner is presented with opportunities to apply the learned information in the lesson, modifications on the quantity and difficulty of the material are made when necessary to ensure

compatibility of the learner's ability with the lesson material presented.

Selection of Hardware and Software

In the selection of hardware and software for this project, several factors such as cost, availability of technical support, compatibility with other IAV components, ease of use, and availability of the systems most accessible by the target audience were of major importance. As a result of these considerations, the following components were utilized in the IAV system:

Hardware

Apple IIe computer, with 128k of memory

Panasonic AG-6300 Videotape Player/Recorder

Panasonic CT-1400MG Color Video Data Monitor

BCD Model 450 Interface Card

Software

BCD's Instructor Authoring System
with Logger II (video logging program)

Broderbund's Fantavision graphics generator

Apple Mousepaint

In addition to producing interactive video lessons, this project also involved producing the videotape segments which were used in the lessons. Therefore, video equipment was required to accomplish this task. The video equipment utilized in the production of the videotapes were:

Panasonic WV-6000 Camera

Panasonic NV-A500 Editing Controller

Panasonic NV-8500 Videotape Player/Recorder

Panasonic AG-6300 Videotape Player/Recorder

Hitachi Model CM-1481 Color Display Monitor

JVC Model C-2082UM Video Monitor/Receiver

Resource Determination

The starting point of producing IAV segments in this project was to determine the type and source of video material needed in the lessons. A general idea of what video footage was needed and where to obtain it was very important in order to build up an abundant database of video resources that would be utilized to effectively present the instructional material. This involved researching possible contacts, dates, and locations of obtaining video footage well in advance of the actual filming stage. Again, only a general idea of the type of video footage needed was required in this phase, because the specific video shots were to be determined after the script (which is discussed later in this report) was written.

Design of Lessons

The production of a lesson design for an interactive video segment is very much like the production of a lesson plan for a class period. As stated before, the material to be taught is

based upon the objectives of the lesson; therefore, a complete lesson on a particular subject containing important facts and information on that subject is to be presented to the student. In an interactive video segment, these facts and information are written up in the form of a script.

Writing the Script

The writing of the script is a very important phase in IAV production, not only in organizing the flow of information during presentation of the subject material, but also in obtaining the video footage needed. With the script as a guide, the filming crew will be able to determine exactly what type of footage is needed in order to accomplish the lesson objectives. The structure of the script used in this project was in two-column form: one column (labeled audio) was the script itself from which the narrator of the lesson would read, and the other column (labeled video) was the description of pictures, slides, or video shots that were to be displayed as the narrator read (see Appendix C). These descriptions and the spoken words that went with each description were spaced parallel to one another down each page throughout the script. By following this type of format, the process of editing the audio and video into presentation form was much easier.

Writing Questions and Remedials

After the script is written, a database of questions are

then created which will test how well the student learned the material. The type of questions used in this project were limited by the software. BCD's Instructor Authoring System only allowed the use of multiple-choice, keyword, and true-false questions in the lesson.

The questions should be taken directly from the script so that upon giving an incorrect answer, the student will be branched by the computer to either a remedial segment almost identical to the video scene of the tutorial, or to that specific scene of the tutorial which explained the material from which the question came.

The remedial segment, which the computer will branch to following a correct or incorrect answer, is simply a short video scene which positively reinforces the answer given by the student, explaining why the answer is right or wrong.

Obtaining Video Footage

Once the final script is written and is in presentation form, the process of "shooting" or recording the video should be the next step. As mentioned before, the producer knows at this point exactly what the lesson will be attempting to explain or show as a result of reading the script, and therefore he/she will be able to look for and record specific shots that will support the narration.

Even though the specific shots needed for the lesson are

known, it is a good practice to record many hours of tape of the material to be presented in order that a large database of footage will be created. This will ensure a large selection of footage available for use in the present lesson or for use in future productions.

During the actual filming, many factors should be considered to obtain good, quality video shots. The factors of most importance include the preparation for filming, the determination of the type of shots needed for each scene, the proper filming techniques, the type or types of shots needed for the transition from one part of the lesson to another, and the amount of lighting required. Though additional factors such as the personality style of the lesson, as well as others, play an important role in the type of footage needed, these are the primary factors that should be considered.

Preparation for Filming

The preparation is important to the organization of the filming. Preparations such as checking the equipment for proper working conditions, ensuring a source of power is available at the filming, having a general idea or format of the video needed for the lesson, and ensuring that plenty of videotape is available for the footage desired are some of the important considerations which should be performed before going out to record video footage.

It is essential that the recording equipment is checked before every filming event to ensure that it is working properly. If this checking procedure is not performed, the result could be not only a loss of time, but could also require rescheduling the filming session, returning to the location for a second filming (which could possibly be expensive if the location was a long distance from the recording studio), or possibly a loss of video quality.

When filming is performed outside the recording studio, the primary concern is the source of power for the recording equipment. The Panasonic WV-6000 camera, which was used for the majority of footage for this project, required an AC power source. Therefore, it was essential for the location of the footage to be where AC power was available. An optional battery pack may be purchased with this camera, but was not available at the time of this project. Therefore, some of the footage acquired for this project was obtained utilizing the JVC Color Video Camera. This particular camera had a battery pack thus eliminating the need for AC power. However, battery packs generally last no more than two hours before the power fades away so this was a limiting factor on the amount of time for each filming session where AC power was not available.

Before the actual filming begins, it is helpful to determine which shots should be long, medium, or close-up shots. A long shot consists of a wide view of a given location

such as a field or flock of sheep. This shot is normally used to introduce and/or close a production as well as to introduce each change of location throughout the lesson.

A medium shot generally is the midpoint between a long shot and a close-up shot. It is used for a more intimate view of an object or a small group of objects rather than a broad view of a long shot yet not quite as close as a close-up shot. The views that this type of shot might include are a side view of a lamb or a small group of flowers.

A close-up shot consists of a very detailed look at an object or parts of an object. The closeness of certain objects primarily depends upon the capabilities of the camera utilized in the shoot. The Panasonic WV-6000 camera features an auto iris power control zoom lens which has a macro function that enables the camera to shoot objects at a distance as close as 5 cm (2"). The views that require this type of shot are views such as the reproductive parts of a flower or the fineness of wool or mohair.

These different types of shots should be utilized variably throughout the lesson to increase its effectiveness and aesthetic appeal.

Filming Techniques

Through the review of the literature as well as trial and error on this project, it was found that practicing several

filming techniques were beneficial in obtaining quality video. The utilization of these techniques are very important in order to obtain good, quality video. The filming technique which should be constantly monitored is focusing of the lens. Though this technique does not seem difficult, shooting several objects at varying distances often will cause the camera to become out of focus.

A technique which can ensure that the camera is in focus is to zoom the lens of the camera to an extremely close-up shot of the object which is to be filmed and focus at that point. Then, zoom back to the position at which the actual filming is to be obtained, and the view should be in focus as long as the object remains the same distance from the camera. This technique should be repeated every time another scene is to be shot to compensate for the varying distances of the views which cause the camera to become out of focus.

The amount of light is also an important factor in obtaining quality video footage. The camera which will be utilized in obtaining the footage should contain some function which controls the amount of light allowed to enter the camera during filming. This function, usually called the lens aperature or filter, should be set on the proper setting to obtain the best quality picture. The proper settings for different types of shots and locations (i.e., outside or inside) should be specified in the camera's operating instructions.

Another technique which should be constantly checked is the level of the shot. A tripod should be used for every shot, if possible, to ensure that the camera is level and, perhaps more importantly, to avoid unnecessary movement of the camera.

The filming techniques addressed in this report are only a few of the major points that often can be overlooked during the filming phase. Others, such as cleaning of the lens, checking for proper cable connections, setting of the camera's controls, etc., are either common practices or dependent upon the camera used. It will be very evident which scenes are obtained without performing these filming techniques when the footage is being reviewed during the editing phase of production. Therefore, it is essential that these techniques are recognized and performed during the filming phase.

Computer Graphics

Computer generated graphics are, in some respects, an additional phase in the production of IAV segments. Graphics enhance the video segments by providing a practical means of demonstrating ideas or processes that could not actually be observed or filmed otherwise (Gregory, Styles, & Wheeler, 1986).

A number of graphics packages were evaluated for use in this project, and each one had its own features and capabilities. In selecting one for this project, several factors such as cost and ease of use and learning needed to be determined. The key factor

was to determine which package would generate or have the capability to generate the graphics needed to effectively display the information presented to the student in the lessons being produced for this particular project (for example, a piston moving up and down in a four-stroke cycle engine). Of course, this involved finding a graphics package capable of animating scenes.

The graphics package which was determined to accomplish the previously mentioned factors for this project was Broderbund Software's Fantavision graphics generator. This package required the use of a mouse with the Apple IIe computer and 128 kilobytes of memory. As a result of the purchase of this package, the tutorial segments were enhanced greatly at little cost, and it was quite simple to use.

The graphics used in a lesson should be produced by the computer first, saved to the disk, then transferred to videotape by capturing the graphics on the screen of the video monitor. If the IAV software operates in the Apple DOS 3.3 system and the graphics were produced under the ProDOS system, the file will have to be transferred to the DOS 3.3 system by using the conversion program on the DOS 3.3 Master Disk.

The process of capturing the graphics from the monitor to the videotape involves connecting the proper cables from the videotape recorder to the video monitor. Before describing the connections, an understanding of the cable types should be known.

There are two types of cables which are of concern in this process: video and audio.

The video cables are distinguished from the audio cables by their connecting ends. Video cables normally have the BNC or UHF connections while audio cables contain RCA or MINI adapter connections. If these types of cables are still confusing, the best way to determine which cable should be connected to which port is to study the labeled ports on the videotape recorder and match the ends of the cables to the ports, or read the operating instructions of the videotape recorder.

Another cable which should be recognized is called an 8-pin cable, due to the eight pins which are located in the connectors. This cable provides the video and audio connection between the monitor and VTR as long as both components have 8-pin connection ports.

When the cables have been distinguished from one another, connect the computer's BCD VIDEO OUT cable to the video monitor's VIDEO IN port. Then, another video cable should be connected from the monitor's VIDEO OUT port to the videotape recorder's VIDEO IN port, making sure the monitor selector switch on the back of the monitor is set to the LINE position.

When these connections are completed, the graphics scene(s) should be projected onto the monitor's screen from the computer, and the videotape recorder should be placed in RECORD mode. When enough videotape of the graphics has been recorded, press the

STOP button on the recorder.

In order to ensure that the graphics were captured and recorded on tape, it is a good practice to play back the videotape and check to see if a good recording was made. If not, the process should be repeated until a good recording is obtained.

Editing the Videotape

The editing phase of the project proved to be the most time-consuming phase of the entire project. This phase involves blending the raw video footage, audio (voice and music), and computer graphics together to produce the final video production. This process primarily consists of three parts: (1) recording video black (black burst) onto the videotape which is to be used in the final edited production, (2) laying (recording) the audio script onto the videotape and (3) editing the video scenes onto the videotape corresponding with the audio.

Recording Video Black on Tape

Recording video black onto the tape that will be edited is required in order that the editing machine can have precision frame by frame control of the videotape. Videotapes, when purchased, do not come with video black recorded on them, so this process must be performed before any editing can be done.

The first step involved in accomplishing this process was to connect the audio (both channels) and video cables from the WV-

6000 camera to the audio and video IN ports of the NV-8500 videotape recorder. The camera was turned on, but the lens was kept closed during the entire recording.

When the tape was inserted into the recorder, the PLAY and RECORD buttons on the videotape recorder were pressed simultaneously, advancing the videotape. When the entire tape had been video blacked, this step was completed.

Laying the Audio on Tape

The process of laying audio on tape is simply recording the written script onto a videotape in raw form first, and then editing it into an error-free narration of the lesson. "Raw" form means recording the narrator as he/she reads the entire script, including errors which may occur while recording. When the narrator makes an error during the recording, he/she will pause and repeat the sentence or paragraph once again. When the recording is finished, the editor will "splice" or cut out the error.

Before recording any audio onto the videotape, the proper meter settings on the videotape recorder should be set to obtain the best recorded sound levels. The audio for this project was recorded using a Sony F-V30T microphone plugged into the channel 1 microphone port of the NV-8500 recorder. The microphone should be tested before pressing PLAY-RECORD.

During the testing process, the narrator should read a few sentences into the microphone while the recorder operator sets

the channel 1 audio level around 0 db. The channel 1 audio meter will fluxuate as the narrator reads and the needle should be set around 0 db by turning the channel 1 audio meter knob. When the needle is constantly staying around 0 db, the operator should press the PLAY and RECORD button, followed by the PAUSE button.

When the narrator is ready to begin reading, the operator should press the PAUSE button and the recorder will begin recording. The narrator should then begin to read the script.

Once the entire script has been read, the recording should be edited by using the editing controller board to "splice" or cut out the errors. The editing controller board contains two sides of editing controls. One side controls the source recorder (the recorder from which the audio and video comes from) and the other side of the board controls the editor recorder (the recorder on which the audio and video from the source recorder is to be placed). The editing controller board also has the capability of determining which channel of the videotape to edit: channel 1 audio, channel 2 audio, and/or the video channel.

When the audio script is being edited, only the channel 1 audio button should be pressed (lit up). The other two buttons (channel 2 audio and the video channel) should not be lit and consequently, should not be affected by the editing process.

The general procedure for editing the audio is to locate the exact frame of the sentence to be edited on the source tape (tape

to record from) and simultaneously press the SET and ENTRY buttons on the source recorder's side of the controller board. The set-entry light located in the upper right-hand corner of the time-frame display of the source recorder's side of the controller board will light up to confirm that a set-entry point has been established. The editor tape (tape to record to) is then positioned at the point to accept the audio from the source tape. The SET and ENTRY buttons on the editor's side of the controller board should then be pressed simultaneously and the set-entry light located in the upper right-hand corner of the time-frame display of the editor recorder's side of the controller board will also light up to confirm this action.

In the same manner, one exit point may be set. An exit point is where the source and editor tape will stop recording. Though not required, the set-exit is used primarily for stopping recordings from overlapping into an already edited recording on the editor tape or from continuing the recording into the next segment on the source tape. Whichever the case may be, the set-exit point serves primarily as a pre-defined stopping point in the editing process.

At this point, the entry locations of both tapes have been set and entered into the controller board's memory. Before actually recording from the source tape to the editor tape, the audio should be "previewed" to ensure that the set-entry points are set exactly at the locations desired and more importantly, to

set the sound level of the editor tape. Press the PREVIEW button located on the lower part of the controller board. Both recorders will rewind five seconds prior to each of their set-entry points and then proceed to play from that point. When the set-entry point is reached, the monitor displaying the editor tape will begin to play what is to be recorded onto the tape.

As the audio begins to play, turn the channel 1 audio level knob until the channel 1 meter fluxuates around 0 db. When the meter stays constant around 0 db, the audio level will be correctly set and ready for actual recording.

At any point during the preview mode, the process can be stopped. To do this, the EDIT-STOP button on the controller board can be pressed and the machines will stop. Once it has been determined that the set-entry points are correct, the actual recording from the source tape to the editor tape may be accomplished by pressing the PREVIEW and EDIT buttons simultaneously.

When the PREVIEW and EDIT buttons are pressed simultaneously, the same process occurs as when the PREVIEW button was pressed, except the actual recording will take place. This process also may be stopped at any point by pressing the EDIT STOP button. When the actual recording has finished, the recorded material should then be reviewed by pressing REVIEW. This replays the recorded material which was just transferred to the editor tape.

This continual, time-consuming process is repeated until all the narration is edited onto the videotape in the editor recorder. By completing this, the final edited version will contain no errors and will be in presentation form, ready for the insertion of video scenes to correspond with the narration.

Due to the structure of the lessons in this project, the questions and remedial segments to the questions were placed on the videotape immediately following the tutorial segments. Thus, immediately following the audio for the tutorial segment is the audio for the remedial segments. The audio for the remedial segments is produced and edited in the same manner as the audio for the tutorial segment.

Inserting Video onto Videotape

At this point, the complete narration of the lesson should be on the videotape in presentation form. The video scenes which corresponded with the narration should now be placed on the videotape. The insertion of video onto the edited tape is much like the audio editing process described previously, with only a few minor differences.

The video channel on the controller board is now the only channel that should be pressed (lit up). (In the case that the audio channel 1 light is lit up and the PREVIEW and EDIT buttons are pressed, the audio on channel 1 of the source tape will replace what is on channel 1 of the editor tape, so the selection

of the channels is a very important factor to remember when recording audio and video separately.)

When video is edited onto the videotape in the editor recorder, it is a good practice to back the edited tape up three frames into the previous scene. This ensures a good clean splice with the next scene and avoids a one or two frame blank space in the tape. Though the blank space is not easily seen during a presentation, it causes a quick "blink" in the picture and this can be avoided by backing up three frames. The videotape is now ready to be made interactive.

Computer-generated Frame Code

One of the most important areas involved in the computer production process is the generation of frame code on the videotape. This frame code is required so that the inpoints and outpoints of specific scenes may be located and accessed by the computer. The Apple IIe computer which was utilized in this project provided the capabilites for this procedure.

Interface Connections

Before beginning the actual process of generating code on the videotape, the proper connections between the computer and the VTR need to be made and the settings of the VTR need to be set. This step is the most important step of the code generating process because if one cable or setting is not properly connected or set in the correct position, the whole process may be

unsuccessful.

It should be noted that the connections and settings discussed below pertain to only an Apple IIe microcomputer/ Panasonic AG-6300 videotape recorder setup. For the proper connections and settings of those systems that are not part of this setup, please refer to the operating instructions of the interface device being used. For a more complete explanation of the connections and settings not addressed in this report, please refer to the BCD Associates Model 450 card operating instructions (available from BCD Associates, Oklahoma City).

First, a brief description of the interface device should be known. The interface device is a computer card which is normally inserted into slot number four of the computer. A total of nine cables extend from this card. Five of the cables connect to the VTR, two connect to the monitor, and two normally connect directly into the computer.

The five cables which connect to the VTR consist of the Control Cable (CCP-1), the VTR Audio Channel 1 and Channel 2 Out cables (VTR CH. 1 OUT & VTR CH. 2 OUT), the VTR Video Out cable (VTR VID. OUT), and the VTR Address Code cable (VTR ADDRESS CODE).

The Control Cable (CCP-1) should be connected to the VTR Remote Control Connector. This connector is a 34-pin connector which provides the computer with control of the VTR functions such as play, fast-forward, reverse, etc..

The VTR CH. 1 OUT cable should be connected to the CH1 AUDIO OUT port of the VTR. Since the frame code is to be generated on channel 2 of the videotape, the VTR CH. 2 OUT cable should not be connected to anything. Instead, the VTR ADDRESS CODE cable will connect to the CH2 AUDIO OUT port of the VTR. This cable will read the code on channel 2 of the videotape.

The last cable to connect to the VTR is the VTR VID. OUT cable. This cable should be connected to the VIDEO OUT port of the VTR.

There are two cables which connect to the video monitor. These are the MON. VID. IN and MON. AUD. IN cables. They connect to the monitor's VIDEO IN and AUDIO IN ports, respectively.

The remaining two cables are the CASSETTE IN and COMPUTER VIDEO cables. The CASSETTE IN cable should be connected to the CASSETTE IN jack of the computer. This jack is indicated on the rear of the computer by the picture of a cassette tape with the arrow pointing away from the tape.

If only one monitor is used for both the computer and the VTR, the COMPUTER VIDEO cable should be connected to the VIDEO OUT jack of the computer (indicated by the picture of a monitor on the rear of the computer). When a color monitor is used with the VTR, and a data monitor for the computer, the data monitor should be connected to the VIDEO OUT jack of the computer. In this case, the COMPUTER VIDEO cable is not required to be connected.

Videotape Recorder Control Settings

The control settings on the videotape recorder are also vital to the success of the IAV setup. The following settings are the proper settings which should be set on the Panasonic AG-6300 Industrial type VTR when generating frame code on the videotape. Later in this report, some of these settings will have to be changed to run a lesson, but the settings discussed here pertain only to the code generating procedure.

The Panasonic AG-6300 VTR has several settings on its front panel. There is a top part and bottom part to the front panel. Attention should be paid to the settings which are listed from left to right, beginning with the top part. If a setting is not listed in this report but is present on the VTR, the setting did not have an effect upon the operation of the IAV system.

The TV/VTR setting should be set on VTR. This setting is located directly above the power button of the VTR. The INPUT SELECT setting should be set to LINE. To the right of this setting is the AUDIO LIMITER and the DOLBY NR setting. Both of these settings should be set to ON. The METER TRACKING setting, which is located to the right of the CH2 Audio level knob, should be set to AUDIO CH.2.

The window display, which displays the counter of the videotape, has several buttons under it. The only one which has been found to have an effect on the system is the TAPE MEMORY button. This button should be pressed until there are no symbols

displayed in the window display.

The settings on the bottom part of the front panel also need to be set properly. The listing of these settings also begin from left to right. The AUDIO MONITOR setting should be set on MIX. This setting allows both audio channels 1 and 2 of the videotape to be heard when the videotape is playing. If the setting is placed on either CH1 or CH2, only the channel it is set on will be heard when playing the videotape.

It should be noted that many times, a videotape is played and either no audio is heard, or not all of the audio expected is heard. This sometimes causes a fear of having lost the recorded audio or the fear of not recording the audio correctly. This common mistake of not having this switch set properly has been made many times. If the above example occurs, check this setting before anything else to ensure that this is not the problem.

The AUDIO DUB setting should be set on CH1/CH2. The TIMER, which is directly to the right of the AUDIO DUB setting, should be set to OFF. The SYNC setting is another setting that can cause fear of having done something wrong. If the screen begins to "blink" or get "snowy" in short, distinct pulses, this setting should be checked to ensure it is set on NOR. The VIDEO MODE and TAPE REMAIN should also be set to NOR.

Again, these settings pertain only to the Panasonic AG-6300 VTR and are discussed only as they relate to the IAV system. For

further information and explanation on the settings listed in this report or on those that are not, please refer to the operating instructions of the VTR.

Writing the Frame Code on the Videotape

To begin this code generating process, the Instructor Author disk should be inserted into drive 1, the Student Presentation disk in drive 2, and the power should be turned on. The videotape should be in the VTR at this point.

When the BCD title page appears on the screen, press the ESC key. After doing this, the computer will display the <<<MAIN MENU>>> where the number 3. choice, CREATE/CHANGE A TAPE LOG, should be pressed. After the number 3 is pressed, followed by pressing the RETURN key, the computer will be activated and the screen will display:

```
PLEASE STAND BY...
READING BCD CODE TYPE
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At this point, the computer is determining the type of video recorder to which it is connected and also the type of code it is going to be reading. The computer will shortly realize that the VTR type is PANASONIC/JVC and will proceed to the LOGGER II menu. At the LOGGER II menu, the A for ADDRESS/SYSTEM STATUS key should be pressed. This branches the program to the ADDRESS & STATUS 'A' SUBMENU. At this point, the current status of the system will be displayed.

The name of the file which is in memory, (if one is in

memory), will be displayed on the first line below the menu. Then the status settings will be listed. First, the PROGRAM AUDIO channel will be indicated, either on channel 1, channel 2, or both channels. Following this setting, the FRAME CODE will be designated as OFF or ON.

The STUDENT PRINTER slot number status setting follows the FRAME CODE status setting. NO STUDENT PRINTER will be displayed until otherwise designated. The PREROLL FRAMES status setting is next. This status setting will be set on 120 (default) unless otherwise designated.

The final status setting is the TAPE # setting. This number will be blank until a number is entered. Below these status settings are four options from which the number 1. SELECT AUDIO & CODE CHANNELS, should be selected. Selecting this number will allow the operator to change the settings described above.

The channel which will be used for audio and the one which will be used for the frame code should be known at this point. In this project, channel 1 was designated as the audio channel and channel 2 was designated as the frame code channel.

After entering 1 as the program channel and replying Y for yes to the question asking if frame code was to be used, the TAPE ID number was requested next. This ID number is any number that is desired as long as it is not the same number of another IAV tape. The tape which is in the recorder at the time of entering this information will be recognized by the ID number it is

designated (unless, of course, the number is changed). After entering the Tape ID press RETURN to save it. It is a good practice to write this ID number on the videotape label for future reference.

Normally, if a printer is connected to the computer, slot number 1 should be entered for the slot number which the student printer will be plugged into. This would not be true only if the printer card was not inserted in slot number 1 of the computer or if a printer was not connected at all. In cases such as these, the slot in which the printer card is contained should be designated as the slot which the student printer is plugged. Otherwise, press 0 if no printer is connected.

The PREROLL FRAMES setting may be confusing initially, but continued experimentation with this setting will eventually give a better understanding of how it works. When the computer is fast-forward or fast-reverse searching the videotape for a specific inpoint, the PREROLL FRAMES setting halts the search at a specified number of frames (or seconds) before that specific inpoint. This allows the tape to slow down to its normal playing speed and begin showing the specified video scene. Displayed to the right of PREROLL FRAMES is the DEFAULT number of frames (120) or the number of frames the tape will stop before beginning to play the video scene. Since there are 30 frames in 1 second, the DEFAULT is actually 4 seconds. This PREROLL number may be

changed if the problem of "overrunning" the inpoint is encountered. This annoying and time consuming problem is usually evident when the videotape is fast-forwarding to a specified video scene, stops, begins playing, then reverses one to two seconds beyond its initial stopping point the first time. When this occurs, the PREROLL FRAME may be increased to any number of frames to correct this problem. A good practice to follow concerning this certain setting is to leave it at the DEFAULT setting (120) until an increase is needed.

When all of the status information has been entered, the computer will display the status changes and request verification of them. If everything is correct, press Y for Yes and the ADDRESS & STATUS 'A' SUBMENU will appear again with the changes that were made. At this time, select number 3. WRITE CODE.

When the number 3 is pressed, the videotape will rewind, followed by the statement "SET RECORD LEVEL THEN PRESS SPACE". Set the videotape recorder's CH. 2 AUDIO LEVEL on 0 db by turning the AUDIO CH. 2 knob until the meter is set directly on 0 db. When the meter is set, press the AUDIO DUB and PLAY buttons simultaneously on the videotape recorder, then tap the space bar on the computer once. Do not keep the space bar pressed for a long period of time.

At once, a rapid clicking sound will be engaged. This is evidence that code is being written. If the clicking sound is not heard, check to see if a cable is connecting the monitor

audio to the channel 2 audio port. Also, check the volume level on the monitor.

If channel 2 audio is connected to the monitor and the monitor volume level is turned up, and there is still no sound as described above, then the code is not being generated, and the process should be stopped by pressing the ESC key on the computer. Check the proper connections and settings again and repeat the process until the problem is corrected (i.e. until the clicking sound is heard).

The clicking sound, when engaged, will continue to be heard throughout the entire code generating process. To avoid listening to the code generation, you may turn the volume of the monitor down. Upon completion of the generation of code onto the entire tape, the tape will rewind itself. You will need to tap the space bar once more on the computer and the ADDRESS & STATUS 'A' SUBMENU will appear again.

At this point, the code should be checked to ensure that a good recording was made. Checking for the code may be accomplished by pressing choice number 2. READ CODE in the ADDRESS & STATUS 'A' SUBMENU. When 2 is pressed, the computer asks for verification to read code. Press Y and immediately the videotape recorder will begin playing.

The indication that good code has been recorded is displayed when the videotape recorder stops playing and the ADDRESS & STATUS 'A' SUBMENU reappears. If there was an error in the

generation of the code, the computer will indicate the type of error that occurred.

If no errors are indicated by the computer, then the 0. RETURN TO LOGGER II menu selection should be pressed and this phase is complete.

Logging and Trimming Scenes

Upon completion of the generation of frame code, the video scenes on the videotape are to be identified and given scene numbers. This is what is known as "logging" the tape.

Basically, this process is simply identifying each scene on the videotape by giving it a starting point (inpoint) and an ending point (outpoint), as well as a scene number which identifies it to the computer for access during a lesson. The inpoint and outpoint numbers are the exact hour, minute, second, and frame on the videotape which a particular scene starts and ends.

The scene number is the identification of each scene which has an inpoint and outpoint. For example, if the computer called for scene number 5 on the videotape, and scene number 5 had an inpoint of 00:01:23:15 and an outpoint of 00:01:28:15, the videotape recorder would play a 5 second segment of the tape beginning at 00:01:23:15 and ending at 00:01:28:15 (00:01:28:15-00:01:23:15 = 5 seconds).

The process of giving the scenes their initial inpoint and

outpoint is performed "on the run". This means placing the recorder in the play mode at the beginning of the segment and pressing I for the inpoints and O for the outpoints each time a new scene is desired.

Normally, the only time the I is pressed is to start the logging process because subsequent pressing of the O (outpoint) for one scene automatically sets the inpoint for the next scene to be the same number as the outpoint which was just set.

After the entire tape has been "logged on the run", it is a good practice to save the file to the student presentation disk. This disk, which should be in drive 2 of the computer, will contain the files which present the lessons to the student, as well as contain the logged, recorded scene numbers that are accessed from the videotape. In order to save the logfile on this disk, the D for Display Datafile Sub-menu should be pressed. In this sub-menu, the number 2 choice SAVE FILE should be pressed. The computer will ask which drive to save the file on and drive number 2 should be indicated. The file name is then asked for. When naming files, an accurate, brief description of the file should be developed, which will be easily distinguishable from other files. Press RETURN after entering the file name and the file will be saved on the disk in drive 2. When this is completed, the computer will ask if the file is to be saved again. If a backup disk is desired (which is always a good practice to follow), then insert the backup disk into drive

2 and press RETURN again.

After saving the file to disk, reply N (no) to the prompt "SAVE THE DISK AGAIN?", and the Display Datafile Sub-menu will appear. At this point, press 0 to return to the Logger II menu and the next phase can be started.

During the process of logging "on the run", it is very easy to press the O to set an outpoint before the scene is completely finished or after it has already overrun into the next scene. In order to correct for these simple errors and set the inpoint and outpoint exactly where desired to start and stop, the scenes have to be "trimmed".

The process of trimming is a time-consuming process because each point of a scene (starting point and ending point) has to be reviewed to determine if a blank space is present, if a scene has overrun into the next scene, or if a scene is cut too short.

Once it is determined that trimming is required, the inpoint and/or outpoint has to be adjusted, then reviewed again to ensure that it is correct. This process is often repeated several times before the scene is correctly trimmed.

To get to the point where trimming is to begin, D for Display file should be pressed in the Logger II main menu. The Display Datafile Sub-menu will appear, with seven options to choose from. The number 3. choice, CHANGE THIS FILE & LABEL SCENES, should be pressed and the trimming process can begin. But, before trying to actually begin trimming scenes, a basic

understanding of the scenes and their format is required.

The screen at this point displays a scene number, beginning in the top left-hand corner of the screen, with the letters L, I, O, G in parenthesis beside it. Below this line are in/out locations, followed by a duration period and a label area.

These numbers are all integral parts of the trimming process because they identify each scene by a number, its location and its duration on the videotape. The label field is used for entering brief descriptions of the scene.

The letters which are in parenthesis beside the scene number are one-letter commands. Each of these one-letter commands instruct the computer to perform a certain function during the trimming process.

The letter L is the Label command. When L is pressed, the label field at the bottom of the screen will become inverted (lit up) and the computer will prompt the operator to enter the scene description in 30 characters or less, followed by a RETURN. If more than 30 characters are entered, the computer will inform the user and ask him/her to re-enter the description.

The I command is the Inpoint command. This command is used to enter a new inpoint for the scene. When the I is pressed, the original inpoint (located directly below the scene number) will disappear and the computer will wait for the entering of a new inpoint, followed by RETURN. When entering a new inpoint, colons are not accepted, so entering only the numbers is required (for

example, 00:01:10:15 would be entered as 11015). If no inpoint is entered and the RETURN is pressed, the original inpoint will reappear.

The O is the Outpoint command and has the same function as the inpoint command, except it will change the outpoint of the scene instead of the inpoint. The process of entering an outpoint is the same as entering an inpoint.

The G command is the Goto command. This command instructs the VTR to play the scene number displayed on the computer screen. Once the inpoint and outpoint numbers have been set for a particular scene, pressing the G will play that scene, starting with the inpoint and ending with the outpoint.

The general procedure for trimming a scene involves playing the scene, determining the amount of trimming required on both sides of the scene, re-entering the inpoint and/or outpoint, and then replaying it again to ensure that the scene starts and ends exactly where desired.

A label may be entered for the scene at any time. However, labeling was used as a completion of trimming marker in this project (for example, after completing the trimming of a scene, a label was entered to remind the operator that the scene had been trimmed).

During the trimming process, lengthy scenes with duration periods of up to two or three minutes are often encountered. This normally would result in, if following the general trimming

procedure, having to play and replay the entire two or three minutes of a scene in order to correctly adjust the inpoint and outpoint. Since only the start and end of the scene were required to be seen for the purpose of trimming, a "shortcut" to compensate for the waste of time it took to view the entire scene was developed.

The first step to this "shortcut" is to develop a four-column chart on a notepad which should be referred to during the entire trimming process as an aid to keep track of recorded information discussed below. The four columns were labeled as follows: scene number, the original inpoint of the scene, the original outpoint of the scene, and a description of the scene.

This "shortcut" method of trimming accomplishes the same thing as the general procedure mentioned before, but in two phases. The first phase involves playing and replaying the first few seconds of the scene to adjust the inpoint, and the second phase involves the same process but with the last few seconds of the scene to adjust the outpoint. This trimming "shortcut" thus eliminates having to view all of the video between the inpoint and outpoint. To begin the first phase, record the outpoint of the scene (the numbers in the OUT column on the computer screen) under the outpoint column on the chart. Be sure that the outpoint recorded on the chart corresponds with the scene number which is being trimmed.

Now that the original outpoint is recorded, change the

outpoint where it will exceed the inpoint by 4-5 seconds. This is done by pressing O and entering the numbers (without colons) followed by a RETURN. As stated before, when the letter O is pressed, the OUT location will disappear and is awaiting for the new outpoint to be entered.

Press G to goto the scene now. The logic behind this is to play only 4-5 seconds of the beginning of the scene, which should be enough to determine if the inpoint needs adjusting or not. Be sure to notice if the scene begins to play at the desired location.

If needed, adjust the inpoint by pressing I and entering the numbers followed by a RETURN, then press G again to replay the scene. Just like entering an outpoint, the IN location on the screen will disappear when I is pressed and a new inpoint should be entered.

Enter the inpoint exactly like the outpoint was entered. Continue this until the inpoint is correctly adjusted. When the correct inpoint is located, record the adjusted inpoint on the chart under the inpoint column. The start of the scene (inpoint) is now adjusted and the next phase is to adjust the end of the scene (outpoint).

The process of adjusting of the outpoint is identical to adjusting of the inpoint, with the only difference being the inpoint should be placed 4-5 seconds <u>before</u> the outpoint.

Now replace the outpoint in the computer (O command) with

the original outpoint which is recorded on the chart. Change the inpoint of the computer (I command) to 4-5 seconds before the outpoint.

Press G to play the scene and only the last 4-5 seconds of the scene will be shown. When the tape stops playing, notice when the end (outpoint) occurs and determine if an adjustment is needed. If so, adjust the outpoint (O command) and press G again to replay the ending. Continue this until the outpoint is where desired.

When completed, record the new outpoint on the chart (marking out the original outpoint) and replace the inpoint of the computer with the recorded inpoint on the chart. Do not forget to replace the inpoint back to the recorded inpoint on the chart.

At this point, the inpoint and the outpoint of this scene has been adjusted and one way of remembering that it has been adjusted is to label it. The label is a short description of the scene which may be entered into the computer and should not exceed 30 characters. This is done by pressing L.

When L is pressed, the label field at the bottom of the computer screen will become inverted (lit up). At this time, enter the short description. When finished, press RETURN and the label will be recorded in the computer.

The description may also be recorded on the chart, along with the other information, for assurance. Even though all of

this information is recorded on disk when entered, the written chart will ensure that the times and description of each scene have been logged and are available should the disk file accidently be erased.

Inputting Lesson Material into the Computer

When all the other phases have been completed, the lesson material (text, menus, questions, etc.) is to be entered into the computer. The use of the BCD Authoring System, The Instructor, made this task simple due to the fact that the software asks the operator questions about how he/she would like the lesson to be developed.

The first step to entering the lesson material into the computer is to insert the Instructor Author Disk into drive 1 and turn the power of the computer on. When the BCD logo appears, press ESC to go to the <<<MAIN MENU>>>. There are five choices to choose from at the <<<MAIN MENU>>>. The number 2. choice, AUTHOR/CHANGE A COURSE, should be selected. This will advance the program to the <<<AUTO QUESTION>>> menu, where there are now eight choices to choose from.

At this point, the number 7 choice, ASSIGN LESSON DISK DRIVE, should be pressed. This allows the lessons created to be saved on the Student Presentation disk in drive 2, instead of on the system disk, which is in drive 1. After pressing 7, the computer will ask which drive the lessons should be saved. If

the Student Presentation disk is in drive 2, (which it should be), press 2 and the disk drive will activate, indicating that the drive has been accessed and ready for saving the lessons. The disk drive will stop turning and prompt the user to select another one of the eight choices.

Since a new lesson is to be developed, press 1 for CREATE A LESSON. The name of this lesson is asked for next. Always give a good, short description of the lesson to be created so that it can be distinguished from all other lessons. The name that is given will be placed by the computer, upon your request, into a title file. This file will be a list of the available lessons which a student may take when he/she boots up (runs) an IAV student presentation disk. After entering the name, press RETURN.

After pressing RETURN, the computer will ask if the name is correct. Enter Y to confirm the lesson name, or N to change the name. After entering Y or N, the screen clears and then displays the current lesson page (starting with Page 1) and the Framework Selection Menu. The Framework Selection Menu is a list of possible page types which can be utilized in a lesson. For example, if the first page (screen) of the lesson is to be only text, the (I) Information choice would be selected. If the first page is to show a video scene, then the (V) Video choice would be selected.

During creation of the lesson, one of the nine choices of

page types will be selected for each page in the lesson. Though several lesson formats can be developed with the various page types available, the format of this project was designed to offer the user the flexibility to review, proceed, or quit at various points in the lesson. A basic sample of the type of format which was utilized in this project is discussed in the following paragraphs.

The first page normally is a screen of text introducing the lesson which is about to be viewed. The Information (I) selection is selected and the computer then allows for two paragraphs of text information to be entered. After pressing the RETURN, the page is saved to disk and the Framework Selection Menu is again displayed, waiting for a page type to be selected for page number two.

Following the information page is a menu page from which the user may select his/her route through the lesson. This menu normally consists of the option to begin the lesson, go to a sub-menu, or quit. Based upon the student's response, the computer will branch to the selected section.

The process of creating a Menu (M) page can be accomplished by pressing M at the Framework Selection Menu. Upon doing this, the computer will ask to enter a page heading for the menu page, followed by RETURN. Then, the number of items to have in the menu (maximum of nine) will be requested. Following this, the computer will request the information required for each item,

such as the item description, the video starting and ending scene numbers, and the page to branch to if the item was selected.

When all items have been completed, the computer will ask if the page should be scored and if computer reinforcement is desired. After answering and verifying the questions, the Framework Selection Menu will again be displayed, ready for the selection of the page type for page three. This process continues in this manner until the entire lesson is entered into the computer.

Immediately following the Main Menu of the lesson is the sub-menu. At this menu, the student is assumed to have viewed the tutorial so a menu page with a number of options are listed for the student to select from. Some of the options which the student has the ability to select are review options.

If the lesson has been viewed, (or even if it has not), the review options may be selected in order to replay that portion of the videotape desired to be reviewed. The process for providing the ability to review parts of the tutorial is performed by entering a starting scene number and an ending scene number during the item description process mentioned previously.

In addition to the review options, the option to proceed to the questions over the material is given. If selected, the user will be branched by the computer to the databank of questions which are entered.

Upon completion of the information and menu pages at the

beginning of the lesson, the questions pages are entered which will test the students over the material presented. The type of questions which are available in the BCD Instructor software are multiple-choice, keyword, and true/false. Though it is not listed in the Framework Selection Menu as a page type, a true/false question may be entered in the lesson by utilizing the Menu page type. This is accomplished by indicating that the menu page will only contain two items, a true answer and a false answer. Both of these answers have the ability to play any video scene and both may be branched to any given page.

The Multi-Choice Question (Q) page is the multiple-choice page which, when selected, allows the entering of a five-line question with four possible answers. Each answer, like the Menu items, has specified scene numbers to play as well as a page number to branch to if selected. After these numbers are entered, the computer asks for the correct response(s), and also asks if computer reinforcement is desired and if the page should be scored. Upon entering Y or N to the prompts, the question page is saved to disk and the program returns to the Framework Selection Menu.

A Keyword (K) Question allows the user to type a word or a phrase to answer the question. The responses are entered the same way as the Multi-Choice Question responses except only three choices are provided. The fourth choice to this question is a default branch for a "no match".

The Keyword Question is based upon "key letters" of the response which allows the user to partially misspell the word, as long as the "key letters" are in position. For example, the response FDY will accept any word that has FDY in that order (FunDaY, FryDaY, FriDaY, etc.). If correct spelling is required, the exact spelling of the response should be entered. Each response in a keyword question also has its own scene numbers to be played and page to branch to if selected.

As well as the pages mentioned previously, other page types may be incorporated where desired in the lessons. Some of these page types include a Video (V) page (mentioned previously), an Audio (A) page, a Random (R) page, a Graphics (G) page, and a Tape Record (T) page.

A Video (V) page can access and play any selected scene of the videotape. This can be accomplished by pressing V at the Framework Selection Menu and then entering the starting and ending scene number(s) on the videotape to be played.

The Audio (A) page is identical to the video page except that only the audio of a selected scene on the videotape is played. To accomplish this, select A at the Framework Selection Menu and enter the starting and ending scene number(s) of the scene which contains the audio to be played.

The Random (R) page is ideal for creating a databank of questions and having questions from it being asked randomly during a lesson. By selecting this page type, the computer will

randomly select one of four pre-determined random pages. After pressing R at the Framework Selection Menu, the computer will ask for the four page numbers from which one will be randomly selected when the random page is encountered during the lesson. After entering and accepting the four random pages numbers, the computer will branch back to the Framwork Selection Menu.

The Graphics (G) page loads and displays a previously prepared HI-RES graphic from disk. The graphic should be created prior to the lesson development stage and saved on the presentation disk in DOS 3.3 format (see Computer Graphics earlier in this chapter).

When G is pressed at the Framework Selection Menu, the computer asks the name of the graphic to be displayed. After entering the name, the page to branch to is then requested. Once this has been completed, the page is saved to disk and the program is sent back to the Framework Selection Menu.

The Tape Record (T) page allows the student to be videotaped during a lesson. This is very useful in teaching special techniques such as sign language. Of course, a video camera is required for this page type to be used.

The process required to accomplish this recording is to leave black burst (video blacked tape) where the recording will be placed. This segment of tape will be logged as a scene just as the other scenes are logged on the videotape.

The computer will ask what scene to record on, the page

number to branch to following the recording, and the number of seconds to wait before starting to record. When these questions have been answered, followed by a RETURN, the page will be saved to disk and the program returns to the Framework Selection Menu.

On the last page of the lesson, the number to branch to must be 0. This indicates to the computer that it is the end of the lesson. When the last page is entered, (with the next page to branch to as 0), and the computer returns to the Framework Selection Menu, the ESC should be pressed.

Upon doing this, the computer will ask if the lesson just created should be added to the 'TITLE FILE'. Press Y to add the lesson title (the computer will indicate if the file has already been added). After completing this, the program will return to the <<<AUTO QUESTION>>> menu.

Editing the Lessons

When the lesson has been entered into the computer, the BCD Instructor software allows the creator to change the existing pages of the lesson or add pages to the lesson. One limiting drawback to the software, though, does not allow the insertion of a page into the lesson.

Change/Print a Lesson

The process of changing existing pages simply involves going to the page to be changed, changing the specific item to be changed, and pressing RETURN to confirm the changes.

The first step is to get to the <<<AUTO QUESTION>>> menu and press 2. CHANGE/PRINT A LESSON. This selection allows the creator to change an existing lesson or print it out on a printer (if one is connected).

In order to change specific pages of the lesson, the printer slot should be designated as 0 and N should be the response to PRINT ALL PAGES WITHOUT CHANGES. The page to change will be requested following the entering of the N.

Enter the page number to be changed. When entered, the computer will load that page, display it on the screen, and prompt the user to press the space bar to continue.

After the space bar is pressed, the bottom line of the screen provides prompts for the type of change: Type of page, # for item or paragraph, Header, Question, Video, Branch, or Scoring.

By pressing T for type of page change, the nine page type selections will appear and the one desired for that page should be entered. When a page type is changed, all the information for the new page has to be entered the same way it was entered during the creation process mentioned previously.

The # of item change allows the changing of the response which is entered (for example, if item number 3 on a multiple-choice question needs to be changed, the 3 should be pressed after pressing the # and the new response along with its video scene(s) and branch should be entered).

When the H is pressed, a new header for the page may be entered. The same method is used for changing the Question, the Video scene(s), the Branch to a different page, and the Scoring of the page. When graphics and random pages are to be changed, the entire page is required to be changed.

When all changes have been made, the RETURN key should be pressed at the CHANGE WHICH PAGE# prompt and the computer will return to the <<<AUTO QUESTION>>> menu.

Adding a Page to the Lesson

The process required to add a page to the end of an existing lesson is to select 4. ADD A PAGE TO THIS LESSON, and simply continue entering more pages. One important thing not to forget is to change the branch of the last page from 0 to the first page that is added. This will branch the computer to the next page instead of ending the lesson, which the BRANCH TO 0 would have caused.

When the additional pages have been added, press ESC to exit the process. Again, the computer will ask if the lesson should be added to the 'TITLE FILE'. Press Y to ensure the lesson is added to the title file (the computer will always indicate if the lesson has already been added to the file).

After adding the number of pages desired, remember to branch to 0 on the last page so the lesson will end.

Users Documentation: Apple IIe/Panasonic AG-6300 IAV System

These interactive videotape lessons are designed to be menu-driven, self-paced tutorials in three major areas of agriculture: animal science, plant science, and agricultural mechanics. Each tutorial in the three areas are followed by questions which are asked over the material covered in the tutorial.

These lessons were developed utilizing BCD Associates' The Instructor Authoring System software. They were designed to run on an Apple IIe computer with 128 kilobytes of memory, linked to a Panasonic Industrial type videotape recorder/player.

The procedure for "booting up" (starting) and running any of the lessons is the same for each disk.

Turn the videotape recorder on and insert the videotape which contains the lesson to be viewed. Then, insert the corresponding computer disk labeled with the lesson to be viewed into drive 1 of the computer.

Turn the computer on and in a few brief moments, the BCD Associates logo will appear, with the one-line command "PRESS SPACE BAR TO PROCEED..." being displayed at the bottom of the screen. This command, used frequently throughout the lessons, prompts the user to press the space bar each time he/she would like to proceed to the next screen or part of the lesson.

After the space bar is pressed, the computer will ask the user to type in his/her first and last name. Press RETURN when the name has been entered.

The Student ID# is asked next. This number may be the

student's Social Security Number, assigned number in the class, seat number in the class, etc. Press RETURN when the ID# has been entered.

The computer screen now displays the name and ID# which was entered and asks to verify that it is correct. If the information is correct, press Y (RETURN is not required after pressing Y). If any of the information is not correct, press N (no RETURN required) and the computer will allow the information to be re-entered. Upon completion of the name and ID number, the user will be prompted to enter the date with a format excluding leading zeros (i.e. 1/1/87). After pressing RETURN, the computer will beep and ask if the date is correct. If the date is correct, press Y for yes. If N for no is pressed, the date will have to be re-entered.

Upon entering Y for the correct date, the computer will then display the available lessons which the user may select from. Also displayed on the screen is the message "PRESS ESC TO QUIT". If the student wishes to quit at this point, he/she may do so by pressing the ESC key.

The list of available lessons displayed on the screen are numbered, therefore, the number corresponding to the lesson that is desired to be viewed should be pressed. Upon pressing the number of the desired lesson, the computer asks if the correct lesson was selected. If it is not, press N for no, then select the correct lesson. If it is the correct lesson, press Y.

The initialization procedure will now occur, which is a procedure performed by the computer, ensuring that all components of the IAV system are properly connected and the proper disk and videotape are present. This procedure takes up to a minute to complete.

Upon completion of this procedure, the computer will inform the student that a video scene may be paused by pressing the SPACE BAR and also resume by pressing the SPACE BAR once more.

At the bottom of the screen, the computer prompts the user to PRESS the SPACE BAR and the lesson will begin. From then on, the program is menu-driven throughout the entire lesson until it is completed or until the user presses the number corresponding to QUIT on one of the various MENU screens available during the lesson.

CHAPTER IV

EVALUATION OF SOFTWARE: INTERACTIVE VIDEO VS. VIDEO

Subjects

Students enrolled in Vocational Education for the Handicapped (VEH) Farm and Ranch Repair classes and Coordinated Vocational Academic Education (CVAE) Farm and Ranch Repair classes in vocational agriculture departments were the subjects of this evaluation. Due to limits on time and travel funds available for the study, only those vocational agriculture VEH and CVAE programs located at schools within a 60 mile radius of Lubbock, Texas were selected. This included 4 schools resulting in a total of fifty-five 7-12 grade students who were the subjects.

Variables

The dependent variables were the immediate recall test scores (Test 1) and the post test scores (Test 2). The independent variable was the method of presentation (interactive video and video).

Instruments

A video lesson and an interactive video lesson covering two areas of small gasoline engine operation and maintenance were used as the treatments and were administered in the student's regular classroom. The two subject areas were Four Stroke Theory and Using a Spark Tester to Check Ignition. The video and audio content of the two treatments were identical and lasted about 3 minutes. Students were randomly assigned to the two treatments within a given subject

area. Each student performed a particular lesson according to the treatment group he was in. Upon completion of that lesson, he performed the second lesson utilizing the opposite treatment. For example, if student 1 participated in learning the lesson on Using a Spark Tester to Check Ignition in the IAV treatment group, he then completed the Four Stroke Theory lesson in the video treatment group. Thus, each student knew ahead of time that he would be able to participate in both treatments.

Immediately upon completion of the treatment, an identical test within each subject area was given to the students regardless of the treatment group in which he participated. This test was Test 1 (please see Appendix A). Test 2 covering the same subject matter was administered to the student one week later (please see Appendix B). Again the tests given to the video students and the IAV students were identical.

Treatment of Data

Each test consisted of two questions. If the student answered both questions correctly, that test received a score of two. If only one question was answered correctly, a score of one was assigned, and if both questions were answered incorrectly, the test received a zero score.

Nonparametric statistics were used due to the fact that only three different scores were possible: two, one, or zero. These values are arranged from the largest to the smallest value in terms of measuring how a student performed on the test. Since there is a

need to simply order the elements, this is referred to as an ordinal scale. According to Conover (1980), the statistical method to be used on this type of data is nonparametric.

The Mann-Whitney test was the most appropriate nonparametric procedure to determine if any significant difference existed between the two treatments on each test. Conover (1980) points out that the Mann-Whitney test is the first to consider unequal sample sizes and small samples. This study has both of those characteristics.

Analysis of Data

Within each subject area (Four Stroke Theory and Checking Ignition) for each test (Test 1 and Test 2), the Mann-Whitney test was run to see if there was any significant difference between presenting the lessons by IAV or by video according to the test scores.

On Test 1 in both subject areas, there was a significant difference between IAV and video in favor of IAV. However, on Test 2 there was not a significant difference between the two methods. Therefore, the null hypothesis "There is no measurable difference in the results of interactive video instruction as opposed to the results of video instruction" was rejected for Test 1 and accepted for Test 2.

The null hypothesis "Interactive video is of equal value to video as a method of presenting material" was tested on Test 2, using the Mann-Whitney test. It was determined that they were of equal value thus resulting in an acceptance of the second hypothesis.

Findings

As stated, IAV proved to be a significantly superior method of presenting selected small gasoline engine topics to VEH and CVAE classes as measured by Test 1 (immediate recall test) results. However, as measured by Test 2 (post test), the two methods proved to be of equal value. In Chapter II it was mentioned that IAV is a relatively expensive teaching tool. Therefore, it would appear that if one were judging IAV on the basis of Test 1, it might be worth the cost. But if a decision on whether to use IAV rather than video was based on Test 2's results, it is doubtful that the system would pay for itself.

Many more studies comparing IAV to various teaching methods are necessary before concrete conclusions can be drawn. In conducting future studies, the following recommendations should be considered:

1. The experiment should have more subjects. Of course, this may require more than one year to complete the project.
2. The tests should consist of more than two questions to allow a wider variety of possible scores.
3. There should be more than two subject areas. This will also provide the examiner with more data thus resulting in a more valid study.
4. A control group that has not received any treatment should be tested for a reliable comparison with treatment results.

5. All students should be given an identical achievement test. A t-test can be run using these scores to see if they significantly affect how a student performed on the treatment tests.

In Chapter II it was mentioned that microcomputers and IAV generated enthusiasm among the students thus resulting in increased attention and learning. Enthusiasm and sincere interest was shown on the part of the students that participated in this study thought some of that might be attributed to the novelty of the new technology. Nonetheless, the project staff concluded that this technology holds much promise as a delivery system in today's classrooms based on the findings of this study and others in this field.

CHAPTER V

RECOMMENDATIONS

The development of the IAV software and utilization of the particular system in this project was a major step in the advancement of effective instructional technology. Even though the end product of this project is considered to be the most basic of interactive video technology, it proved to be the stepping stone to a better understanding of the capabilities which exist in this new and exciting instructional medium.

As a result of extensive literature reviews and experimentation with this system, it was found that the instructional effectiveness could be increased tremendously with the incorporation of a more sophisticated and faster system, such as an interactive videodisc system. The utilization of an interactive videotape system is effective and powerful, but it has disadvantages which a videodisc system can resolve.

The primary disadvantage of an interactive videotape system when compared to an interactive videodisc system is the time it takes to access a video scene on the tape. It is not uncommon for this process to take as much as 30 seconds on a videotape, due to its sequential format. This time period would seem to have a negative effect upon a student during a lesson if he/she has to wait for a long period of time to be responded to after entering an answer to a question. The maximum access time to search for any scene on a videodisc is less than 3 seconds so

this is a definite advantage over the videotape.

Another disadvantage of the videotape is "tape slippage". This is the process in which the tape "slips" or stretches by a point which the computer tries to stop it. This occurs when the computer tries to stop the tape at a designated IN-POINT of a scene, and due to the slippage, the IN-POINT is over-run. As a result of this, the computer instructs the VTR to stop, rewind a few seconds, and then start again to access the point. By doing this, more time is added to the already lengthy access time.

Another disadvantage of videotape is concerned with the quality of the video which is presented to the student. A first-generation 1/2-inch videotape primarily consists of the video footage which was recorded by the camera, and it is usually of relatively good quality. However, when producing an interactive videotape, the second-, third-, or possibly even fourth-generation videotapes are the interactive tapes that are actually used for presenting lessons. This is because the first-generation tape has to be edited from first-generation (source video) down to second generation (edited video). This edited version is the master tape, which then has to be copied, and now becomes third-generation and if more copies are needed, possibly even fourth-generation could be used. Each time a videotape is copied to a lower generation, some of the quality is lost and by the time a fourth-generation tape is produced, there is a great amount of difference in quality compared to the prior

generations.

In addition to this, videotapes tend to lose their video quality as the tape is repeatedly played. Thus, over time, the quality of the videotape will deteriorate.

Usually, a videodisc is produced from an edited 3/4 or 1-inch videotape. There is not much quality lost, if any at all, and the quality becomes permanent indefinitely, provided the disk is not physically damaged.

This is due to the fact that the disc has an outer coating which protects it from abrasive or destructive particles which usually destroy any magnetic medium. In addition to this protective coating, the disk is never touched by a stylus (like a phonograph record) or read head (like a videotape). Instead, a laser disc is beamed at the surface of the disc and reads the "pits" which are embedded on the disk, never touching the surface (see videodisc in the Definition of Terms).

The final disadvantage of videotapes when compared to videodiscs is having to generate a code on the videotape so that each scene may be numbered and thus accessible by the computer. This time-consuming process has to be performed on all videotapes which will be used for presenting interactive video lessons.

Normally, a videodisc has 54,000 frames per side, and each frame has its own number which the computer may access. Thus, the scenes are already present on the videodisc and do not have to be generated.

Though there are disadvantages to an interactive videotape system, there are advantages as well, which cause the development of interactive videotapes to be the most feasible medium of interactive video technology.

The cost advantage of interactive videotapes is by far the primary factor which makes videotape more feasible than videodisc. Since IAV technology is relatively new, the cost to produce or purchase interactive videotapes is considerably less expensive at this time than is interactive videodiscs. The high cost of videodisc is bound to change, just as other new innovative technologies have in the past (for example, microcomputers). Presently, however, the interactive videotape has a distinct advantage of cost.

In addition to cost, the availability of present video sources on videotape provides an advantage over videodisc due to the very small number of videodiscs that are available. However, as mentioned previously, the expected decreased cost of interactive videodisc should produce an increase in the number of available videodiscs in the future.

In addition, as mentioned in Chapter II, videotapes are relatively easy to produce, edit, and revise as compared to videodiscs.

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APPENDIX A

STUDENT NUMBER_____ DATE_____

SPARK TESTER - 1

Please the circle the correct choice.

1. What tool is used to check ignition?

   a. hammer
   b. spark plug socket
   c. spark tester
   d. screwdriver

2. Improper ignition can be caused by:

   a. improper armature air gap
   b. improper ignition point gap
   c. a faulty primary ground wire
   d. all of the above

STUDENT NUMBER_____ DATE_____

FOUR STROKES - 1

Please circle the correct choice.

1. The spark ignites the air-fuel mixture which drives the piston down on which one of the following strokes?

a. exhaust
b. power
c. intake
d. compression

2. The exhaust valve is open on which one of the following strokes?

a. exhaust
b. power
c. intake
d. compression

APPENDIX B

STUDENT NUMBER_____ DATE_____

SPARK TESTER - 2

Please circle the correct choice.

1. Improper ignition can be caused by:

   a. improper armature air gap
   b. improper ignition point gap
   c. a faulty primary ground wire
   d. all of the above

2. What tool is used to check ignition?

   a. hammer
   b. spark plug socket
   c. screwdriver
   d. spark tester

STUDENT NUMBER_____ DATE_____

FOUR STROKES - 2

Please circle the correct choice.

1. The exhaust valve is open on which one of the following strokes?

   a. compression
   b. exhaust
   c. power
   d. intake

2. The spark ignites the air-fuel mixture which drives the piston down on which one of the following strokes?

   a. compression
   b. exhaust
   c. power
   d. intake

APPENDIX C

IDENTIFYING BREEDS OF SHEEP

VIDEO SCRIPT	AUDIO SCRIPT
LS Sheep grazing	There are over 22 breeds of sheep in the United States.
MS Small flock in feedlot pen	We will show you most of these breeds broken down into 5 basic groups:
MS Side view of Rambouillet	the Fine Wools
MS Side view of Lincoln	the Long Wools
MS Side view of Columbia	the Crossbred Medium Wools
MS Side view of Suffolk	the Meat Types
MS Side view of Finn Sheep	and the Other types.
MS Front view of Merino	The Fine Wools are white in color.
CS Face and front legs of Merino	They have fine, silky hair on their face and legs.
CS Head of Rambouillet ram: 1 with horns & 1 polled	The rams can be polled or horned.
CS Head of Rambouillet ewe with scurs	The ewes are polled or may have small scurs.
CS Flock Rambouillets grazing	The advantages fine wool sheep possess include
CS Side view of Merino - zoom in on wool	wool production - both in terms of quality and quantity,